

2011 ANNUAL GROUNDWATER REPORT

**PERFLUOROCHEMICAL (PFC) GROUNDWATER ASSESSMENT
AND
HYDRAULIC CAPTURE ZONE EVALUATION**

3M WOODBURY, MN

NOVEMBER 2011

by

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TABLE OF CONTENTS

Section	Page
1. INTRODUCTION.....	1-1
1.1 REMEDIAL DESIGN/REMEDIAL ACTION (RD/RA) PROGRAM.....	1-1
1.2 CHRONOLOGY OF RECENT ACTIVITIES.....	1-2
2. SAMPLING PROGRAM.....	2-1
2.1 GROUNDWATER SAMPLING PLAN.....	2-1
2.2 GROUNDWATER SAMPLING EVENTS.....	2-1
3. HYDRAULIC EVALUATION.....	3-1
3.1 MODIFICATION OF MONITORING WELL MW-6L.....	3-2
3.2 BOREHOLE GEOPHYSICS.....	3-3
3.3 WATER LEVEL MONITORING.....	3-5
4. RESULTS.....	4-1
4.1 GROUNDWATER RESULTS.....	4-1
4.1.1 Sentinel Well.....	4-1
4.1.2 Barrier and Monitor Well Results.....	4-3
4.1.3 Residential Well Sampling Results.....	4-3
4.2 HYDRAULIC EVALUATION RESULTS.....	4-4
4.2.1 Barrier Well Flow Rate Data.....	4-4
4.2.2 Water Level Measurements.....	4-4
4.2.3 Groundwater Elevation Contour Maps.....	4-5
5. FINDINGS.....	5-1
6. RECOMMENDATIONS.....	6-1



FIGURES

Figure	Page
Figure 1-1 Well Location and Topographic Map	1-5
Figure 2-1 Groundwater Monitoring Network	2-3
Figure 3-1 Geologic Cross Section Transect	3-7
Figure 3-2 Geologic Cross Section	3-8
Figure 4-1 PFBA Sampling Results	4-7
Figure 4-2 PFOA Sampling Results	4-8
Figure 4-3 PFOS Sampling Results	4-9
Figure 4-4 Groundwater Elevation Contour Map-Shallow Wells Pumping Conditions October 21, 2010	4-10
Figure 4-5 Groundwater Elevation Contour Map-Shallow Prairie Du Chien Wells Pumping Conditions October 21, 2010	4-11
Figure 4-6 Groundwater Elevation Contour Map-Jordan Aquifer October 21, 2010	4-12
Figure 4-7 Groundwater Elevation Contour Map-Shallow Wells Pumping Conditions May 19, 2011	4-13
Figure 4-8 Groundwater Elevation Contour Map-Shallow Prairie Du Chien Wells Pumping Conditions May 19, 2011	4-14
Figure 4-9 Groundwater Elevation Contour Map-Jordan Aquifer May 19, 2011	4-15
Figure 4-10 Groundwater Elevation Contour Map-Shallow Wells Pumping Conditions October 31, 2011	4-16



Figure 4-11 Groundwater Elevation Contour Map-Shallow Prairie Du Chien
Wells Pumping Conditions October 31, 2011 4-17

Figure 4-12 Groundwater Elevation Contour Map-Jordan Aquifer October 21, 2010..... 4-18



TABLES

Table	Page
Table 2-1 Groundwater Monitoring Plan.....	2-4
Table 2-2 Groundwater PFC Sampling Events Since October 2010.....	2-5
Table 4-1 Groundwater PFC Analytical Data-October 2010-November 2011 Sampling Events	4-19
Table 4-2 Barrier Well Flow Rates.....	4-23
Table 4-3 Depth-to-Groundwater Elevation Data-October 2010-October 2011	4-24



ATTACHMENTS

- ATTACHMENT A MW-4L AND MW-6L BOREHOLE GEOPHYSICS
- ATTACHMENT B1 DATALOGGER HYDROGRAPHS
- ATTACHMENT B2 MANUAL DTW HYDROGRAPHS



1. INTRODUCTION

This report has been prepared by Weston Solutions, Inc. (WESTON®) for 3M Company and is the annual report that includes an assessment of the groundwater at the former 3M Woodbury disposal site, in Woodbury, MN (the site). This report covers the October 2010 through November 2011 time-frame.

1.1 REMEDIAL DESIGN/REMEDIAL ACTION (RD/RA) PROGRAM

3M entered into a Settlement Agreement and Consent Order (the Agreement) in May 2007 with one purpose being the conducting of remedial investigations and response actions to address perfluorochemicals (PFCs) at the site (see Figure 1-1 for the location). In accordance with the Agreement between 3M and the MPCA, 3M has been conducting remedial investigations and response actions to address PFCs present at the site. As required by the Agreement, 3M submitted to the MPCA a Remedial Design/Response Action (RD/RA) Plan for addressing the PFCs at the site in April 2009. MPCA provided technical comments to 3M on the Woodbury RD/RA Plan and a response to comments letter was submitted by 3M to the MPCA in May 2009. The MPCA approved the RD/RA Plan in their letter to 3M dated June 1, 2009. The RD/RA Plan specifies a long-term groundwater monitoring network for the site to be implemented after response actions at the site have been completed.

The excavation and removal of soils containing PFCs in the former Main Disposal Area was completed in Fall 2009 and the excavation and removal of soils containing PFCs in the former Northeast Disposal Area was completed in Winter 2010 (final grading and seeding was completed in May 2011).

A letter to the MPCA from 3M requesting approval to reduce pumping from the Barrier Wells at the Woodbury site was submitted to the MPCA on March 16, 2010. This request for reduced pumping also included a groundwater monitoring plan to document that groundwater capture would still be achieved while pumping from the Barrier Wells is reduced. MPCA comments to the March 16, 2010 letter request were sent to 3M in a



June 30, 2011 letter and it included requirements for expanding the groundwater monitoring network proposed in 3M's letter request. Following the completion of several infrastructure changes to implement the Barrier Well reduction program, 3M sent a response to these MPCA requests in a letter dated January 12, 2011. The MPCA requirements, in conjunction with the groundwater monitoring network for the site presented in the RD/RA Plan, were used to develop a Groundwater Sampling Plan for the Woodbury site. The Groundwater Sampling Plan, (WESTON, June 2011) was submitted to the MPCA on June 16, 2011. Approval of the Sampling Plan with comments was provided by MPCA in letter to 3M dated August 23, 2011.

The MPCA approved RD/RA Plan indicates that the three components that will be addressed by the RA long-term monitoring plan for groundwater as follows:

- Verification that the extraction system maintains hydraulic capture of site groundwater.
- Documentation of groundwater quality as required by the Minnesota Decision Document (MDD).
- Documentation that treated groundwater is discharged in accordance with state requirements.

1.2 CHRONOLOGY OF RECENT ACTIVITIES

As part of the long term groundwater monitoring at the site, numerous wells were identified to be sampled and analyzed for PFCs. The number of wells and the frequency of sampling were established in the MPCA approved Groundwater Sampling Plan. The Groundwater Sampling Plan includes wells identified to be sampled as presented in the RD/RA and additional wells as a result of the pumping reduction request. In order to establish baseline groundwater quality data prior to the pumping reduction, the quarterly groundwater sampling program was initiated in October 2010. Subsequent quarterly sampling events were performed in February, May and August 2011.



On March 11, 2011 the initial pumping reduction plan was implemented. The results of the May 2011 quarterly groundwater sampling indicated for the first time, concentrations of certain PFCs in several sentinel wells at the southern property boundary. As a result of these detections, and as agreed to with MPCA, 3M returned Barrier Well B-2 to service and increased the pumping rate at Barrier Well B-3 to its pre-reduction pumping rate on September 14, 2011. Additionally, 3M increased the frequency of sampling and the number of wells to be sampled to collect additional data to evaluate trends. The following summarizes the timeline of events that occurred and additional sampling that was performed associated with the pumping reduction program:

- October, 2010: 1st annual sampling event.
- February, 2011: 1st quarterly groundwater sampling.
- March 2011: Implemented the first step of the reduction in pumping by shutting down Barrier Well B-2 and reducing pumping at B-3 to reduce the overall extracted groundwater flow rate by approximately 175 gallons per minute (GPM) (approximately a 5.8% reduction).
- April 22, 2011: Monitoring well MW-6L was reconstructed (as MW-6LR) due to blockage in the well and concerns of an improper grout seal. The borehole geophysics program was also completed at this time.
- May 19, 2011: 2nd quarterly groundwater sampling performed.
- May 30, 2011: Annual Memorial Day weekend Barrier Well shutdown for maintenance.
- August 22-23, 2011: 3rd quarterly groundwater sampling performed.
- August 23, 2011: May quarterly groundwater sampling results issued by the laboratory.
- September 12, 2011: WESTON provided an evaluation of the data to 3M.
- September 14, 2011: 3M initially notified MPCA of the laboratory results.



- September 14, 2011: 3M returned Barrier Well B-2 to service and increased pumping of B-3.
- September 14, 2011: Initiated weekly sampling of Barrier Wells B-2 and B-4 and bi-weekly sampling of select sentinel wells and monitor wells.
- September 28, 2011: 3M and WESTON met with MPCA to review quarterly sampling data.
- September 30, 2011: 3M met with the City of Cottage Grove, MDH and MPCA.
- September 30, 2011: MPCA initiated a residential well sampling event. 3M collected split samples with MPCA.
- October 12, 2011: 3M and WESTON met with MPCA to present information on activities completed and data collected to date.
- October 17, 2011: Planned transects for seismic survey submitted by 3M to the MPCA.
- October 20, 2011: A 3M plan to conduct an Electrical Resistivity (ER) geophysical survey was submitted to MPCA.
- October 21, 2011: 3M received MPCA concurrence on the geophysical surveys.
- October 24-28, 2011: ER geophysical survey was performed and 2nd annual groundwater sampling was performed. Groundwater samples were split with MPCA's contractor, West Central Environmental Consultants.
- November 3, 2011: 3M and WESTON met with MPCA to review weekly/bi-weekly PFC sampling data.



- Legend:
- Monitoring Well Locations
 - Sentinel Well Locations
 - Barrier Well Locations
 - Approximate Woodbury Site Boundary

Figure 1-1
 WOODBURY WELL LOCATION
 AND TOPOGRAPHIC MAP

3M WOODBURY SITE
 WOODBURY, MN



2. SAMPLING PROGRAM

2.1 GROUNDWATER SAMPLING PLAN

As identified in the Groundwater Sampling Plan and based on subsequent MPCA comments, the groundwater monitoring network at the Woodbury site Figure 2-1 consists of 42 monitor and sentinel wells, and four Barrier Wells. As shown in Table 2-1, 19 monitor, sentinel and Barrier Wells are sampled for PFCs at the Woodbury site on a quarterly basis until response actions are complete. These wells include the MPCA requested monitoring network associated with 3M's request for reduction in pumping and Barrier Wells B-1, B-2, B-3 and B-4. Depth-to-groundwater measurements are recorded monthly at the wells indicated in Table 2-1. Annual long-term groundwater sampling is conducted at the 24 wells identified in the RD/RA Plan (i.e. identified by "RD/RA" in Table 2-1). Also, an annual PFC sample (identified as CMW) is collected from the conveyance line at a point where flow from the Barrier Wells has been combined. The groundwater monitoring well network at the Woodbury site is shown in Figure 2-1. (The conveyance line sample point (CMW) is located at the Cottage Grove Facility and is not shown on Figure 2-1).

2.2 GROUNDWATER SAMPLING EVENTS

Prior to reduction in the Barrier Well pumping rates, the first annual groundwater sampling round was performed in October 2010 and a quarterly sampling round was performed in February 2011. The next two quarterly groundwater sampling rounds were performed in May 2011 and August 2011 after Barrier Well pumping rates were reduced (Table 2-2). For the October 2010 annual sampling event, groundwater samples were collected from 13 sentinel wells, 8 monitor wells, one former residential well, and four Barrier Wells. In the February, May and August 2011 quarterly sampling events, groundwater samples were collected from 6 sentinel wells, 7 monitor wells, and one former residential well. Groundwater samples were collected at all four Barrier Wells in October 2010 and February 2011, and the three operating Barrier Wells (B-1, B-3, and B-4) in May and August 2011.



Groundwater samples were collected for analyses of three PFC compounds perfluorobutanoic acid (PFBA), perfluorooctane sulfonate (PFOS), and perfluorooctanoic acid (PFOA) during the October 2010 and February 2011 sampling rounds. Per MPCA request, perfluorohexanoic acid (PFHS) was added to the list of PFC compounds during the May 2011, sampling round and perfluorobutane sulfonate (PFBS) was added per MPCA's request for the August 2011 sampling round and subsequent sampling rounds.

Following the August 2011 sampling, additional groundwater sampling was performed at select wells after PFOA and PFOS were detected during the May and/or August 2011 sampling rounds in southern sentinel wells S01JS, S01PC, S02DR, S02JS and S02PC. On September 14, 2011, 3M notified MPCA of the aforementioned analytical results, returned barrier well B-2 to service and increased the pumping rate at B-3. Weekly sampling of B-2 and B-4 was initiated by 3M on September 14 and bi-weekly sampling was initiated on September 20-21, 2011 at wells S01PC/JS, S02DR/PC/JS, MW-6LR and MW-12. The September 20-21, 2011 results confirmed the detections and MPCA requested that the following six wells be sampled in addition to the seven wells previously sampled: S03PC/JS, SO4SP/PC, MW-10 and MW-G. These wells were sampled on October 4, 2011 and again as part of the October 24 – 28, 2011 annual sampling round (except MW-10 was only sampled during the October 4, 2011 sampling round) per MPCA staff request.

The sampling locations and dates are presented in Table 2-2.



Legend:

	Monitoring Well Locations
	Sentinel Well Locations
	Barrier Well Locations
	Approximate Disposal Area Boundaries
	Site Boundary

0 500 1,000 Feet

FIGURE 2-1
GROUNDWATER
MONITORING NETWORK
3M WOODBURY SITE
WOODBURY, MN

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**Table 2-1
Woodbury Site Groundwater Monitoring Plan
Woodbury, MN**

Well ID	Depth-to-Groundwater Measurement	PFC Sample	Rationale for Sampling	Well ID	Depth-to-Groundwater Measurement	PFC Sample	Rationale for Sampling
B-1	X ⁽¹⁾	Q, A	RD/RA RAP	MW-H	X	Q, A	BWPRP ⁽³⁾ RD/RA
B-2	X ⁽¹⁾	Q, A	RD/RA RAP	MW-J	X		
B-3	X ⁽¹⁾	Q, A	RD/RA RAP	MW-K	X		
B-4	X ⁽¹⁾	Q, A	RD/RA RAP	S01JS	X	Q, A	BWPRP ⁽³⁾ RD/RA
MW-1				S01PC	X	Q, A	BWPRP ⁽³⁾ RD/RA
MW-2	X	Q, A	BWPRP ⁽³⁾ RD/RA RAP	S02DR	X	Q, A	BWPRP ⁽³⁾ RD/RA
MW-3	X		RAP	S02JS	X	Q, A	BWPRP ⁽³⁾ RD/RA
MW-4L	X	Q, A	BWPRP ⁽³⁾ RD/RA	S02PC	X	Q, A	BWPRP ⁽³⁾ RD/RA
MW-4	X	Q	BWPRP ⁽³⁾	S03JS	X	Q	Per MPCA Request
MW-5	X		RAP	S03PC	X	Q	Per MPCA Request
MW-6	X	Q	BWPRP ⁽³⁾	S04PC	X	A	RD/RA
MW-6LR	X	Q	BWPRP ⁽³⁾	S04SP	X	A	RD/RA
MW-7	X		RAP	S05JS	X	A	RD/RA
MW-8	X		RAP	S05PC	X	A	RD/RA
MW-9	X			S05SP	X	A	RD/RA
MW-10	X			S06JS	X		
MW-11	X		RAP	S06PC	X	Q	
MW-12	X	Q	BWPRP ⁽³⁾	S07JS	X		
MW-B	NA			S07PC	X	A	RD/RA
WR-03	X	Q, A	BWPRP ⁽³⁾ RD/RA, RAP	S07SP	X	A	RD/RA
WR-04			RAP	S08JS	X	A	RD/RA
WR-13			RAP	S08PC	X	A	RD/RA
WR-5828			RAP	S09JS	X	Q, A	BWPRP ⁽³⁾ RD/RA
WR-08	X			CMW ⁽⁴⁾	N/A	A	
MW-F	X						
MW-G	X	A	RD/RA				

⁽¹⁾ - A Depth-to-groundwater measurement will be recorded if pump is not operating.

⁽²⁾ - This well was plugged and abandoned prior to excavation activities in the former Northeast Disposal Area.

⁽³⁾ - Well proposed for sampling under the Barrier Well Pumping Reduction Plan, submitted to MPCA in March 2010 or added per subsequent MPCA comments.

⁽⁴⁾ - Conveyance line sample location for combined flow.

NA - Not accessible, obstruction in well

Q - Groundwater samples will be collected from these wells on a quarterly basis until response actions are complete and analyzed for PFOA, PFOS, PFBA, PFHS and PFBS.

A - Groundwater samples will be collected from these wells on an annual basis after completion of response action for 13 PFCs during the 1st and 2nd annual event and may be reduced thereafter.

RD/RA - Well proposed for annual long-term monitoring in the RD/RA Plan.

RAP - Remedial Action Plan



Table 2-2
Summary of Groundwater PFC Sampling Events Since October 2010
Woodbury Site
Woodbury, MN

Well ID	Start Date of Sampling Event											
	10/21/10	02/07/11	05/17/11	08/22/11	09/14/11	09/20/11	09/27/11	10/05/11	10/11/11	10/18/11	10/24/11	11/08/11
B-1	X	X	X	X							X	
B-2	X	X			X	X	X	X	X	X	X	X
B-3	X	X	X	X							X	
B-4	X	X	X	X			X	X	X	X	X	X
MW-2	X	X	X	X							X	
MW-4L	X	X	X	X							X	
MW-4	X	X	X	X							X	
MW-6	X	X	X	X							X	
MW-6L	X	X										
MW-6LR			X	X		X		X			X	X
MW-10								X				
MW-12	X	X	X	X		X		X			X	X
WR-03	X	X	X	X							X	
MW-G	X							X			X	
MW-H	X	X	X	X							X	
S01JS	X	X	X	X		X		X			X	X
S01PC	X	X	X	X		X		X			X	X
S02DR	X	X	X	X		X		X			X	X
S02JS	X	X	X	X		X		X			X	X
S02PC	X	X	X	X		X		X			X	X
S03JS								X			X	X
S03PC								X			X	X
S04PC	X							X			X	
S04SP	X							X			X	
S05JS	X										X	
S05PC	X										X	
S05SP	X										X	
S06JS												
S06PC				X							X	
S07JS												
S07PC											X	
S07SP											X	
S08JS	X										X	
S08PC	X										X	
S09JS	X	X	X	X							X	
CMW											X	

CMW - Sampling point for combined groundwater from Woodbury Barrier Wells.



3. HYDRAULIC EVALUATION

A *Request to Reduce Pumping Plan* (Plan) for the Woodbury site was submitted by 3M to the MPCA on March 16, 2010. The objective of the Plan was to preserve groundwater resources in Woodbury while still preventing groundwater potentially impacted with PFC compounds from migrating off-site. As stated in the Plan, the Woodbury Barrier Well system consists of four (4) wells pumping at an average combined rate of 2,800 to 3,300 gallons per minute (gpm). A number of studies to evaluate the effectiveness of the site Barrier Well network have been completed by several different consultants (Bruce Liesch, Conestoga-Rovers & Associates, Barr Engineering, and WESTON). All of these studies have reached the same conclusion that the Barrier Well network provides an effective hydraulic barrier that prevents groundwater originating in the vicinity of the former Main and former Northeast Disposal Areas at the referenced site from migrating off-site. The performance of the Barrier Well system was evaluated by WESTON during two separate studies performed in May 2007 and May 2008 (WESTON, 2007, 2008). These studies combined with calculations provided in the ~~Plan~~ determined that the Barrier Well system was capturing potentially impacted groundwater and that the Barrier Wells flow rates could be reduced and still maintain groundwater capture. The results of the WESTON evaluation were submitted to MPCA in the March 2010 Plan. The MPCA approved a phased implementation of the Plan with comments in a letter to 3M on June 30, 2010. Responses to the June 30, 2010 comments were addressed in a January 12, 2011 letter from 3M to MPCA, following the completion of several infrastructure changes to implement the Barrier Well pumping reduction program.

The initial reduction in pumping was initiated on March 11, 2011 when Barrier Well B-2 was turned off and the flow rate at Barrier Well B-3 was decreased. The overall reduction in pumping amounted to a decrease of approximately 175 gpm, or 5.8 percent. Flow rates for the Barrier Wells are recorded during the groundwater sampling rounds and are also recorded electronically by 3M production systems.

As part of MPCA's approval of 3M's *Request to Reduce Pumping Plan*, MPCA requested that the following tasks be completed:



- Monitoring wells MW-4, MW-4L and MW-6L be gamma, caliper, and video logged to determine whether the open intervals of these wells intersect the high transmissivity zone (HTZ) of the Prairie du Chien Group;
- Transducers be installed in several wells of interest to continually record water level responses to changes in pumping rates.

The actions performed by 3M in response to these requests are provided in the following sections.

3.1 MODIFICATION OF MONITORING WELL MW-6L

Prior to the performance of the borehole geophysics at the monitoring wells requested by MPCA, sediment that had accumulated in the open borehole of monitoring well MW-6L had to be removed. In January 2011, an attempt to redrill this well and remove the sediment was made using an air rotary drilling rig; however, sediment from the overlying glacial drift unit continued to accumulate in the open borehole section (231 to 320 feet below ground surface (ft bgs)) of the well indicating that the outer grout seal of this well was no longer intact. Due to the damaged seal, this well needed to be reconstituted, and a roto sonic drilling rig was mobilized to the site once ground surface conditions improved in April 2011. The roto sonic rig is capable of advancing outer casing during drilling to prevent sediment from entering into the open borehole section of the well.

Using the roto sonic rig, the well was overdrilled to remove the outer steel casing. The well was then redrilled and the roto sonic rig was successful in removing all sediment from the open borehole. After the sediment was removed and the borehole drilled to the previous depth of completion, the roto sonic drill casing was retracted to a depth where borehole collapse was not a risk. Borehole geophysics were then run in the well while the roto sonic rig was set over the borehole. After completion of the borehole geophysics, the well was renamed (MW-6LR) and a 2-inch screen (280 to 320 ft bgs) and riser were placed within the former open borehole interval of the well. The screened interval was targeted to monitor the middle of the Prairie du Chien formation, which is believed to be the HTZ of this formation. The redrilling and modifications to this well were completed



under an approved MDH reconstruction well permit using the existing unique well number (MDH ID No. 520037).

3.2 BOREHOLE GEOPHYSICS

The suite of borehole geophysics (gamma, caliper and video logging) requested by MPCA were completed in monitoring wells MW-4L and MW-6LR in January and April 2011, respectively. Monitoring well MW-4 is screened from 93 to 128 ft bgs across the St. Peter Sandstone and upper Prairie du Chien Group. This depth is too shallow to intersect the HTZ near the middle of the Prairie du Chien Group, so borehole geophysics could not be performed at this location, due to field constraints. The geophysical and video inspection logs for monitoring wells MW-4L and MW-6LR are included in Attachment A.

The following observations/interpretations can be made based on the borehole geophysics performed in each monitor well:

- **Monitoring well MW-4L**
 - The 4-inch steel casing in this well extends to 122 ft bgs, and grout extends to 124.2 ft bgs;
 - The total depth of the well was measured at 187.1 ft bgs;
 - The caliper logs reveal increases in borehole diameter present at approximately 124, 136, 152, 175, and 185 ft bgs;
 - The video inspection log showed water/sediment flowing from higher in the borehole into the fracture present at 152 ft bgs. The fracture at this depth appeared to be horizontal, possibly associated with a bedding plane. Flow observed across this zone is likely due to the pumping of nearby Barrier Well B-3.



- **Monitoring well MW-6LR**

- The depth that the borehole geophysics and video logging could be performed in this well was limited due to borehole integrity. In order to limit the risk of borehole collapse, the drill stem was advanced to approximately 278 ft bgs. Therefore, the open borehole of the well that was logged using borehole geophysics was from 278 to 321 ft bgs;
- The total depth of the well was measured at 321 ft bgs;
- The caliper log identified a significant fracture zone from 280 to 290 ft bgs;
- The video log was inconclusive due to high turbidity of the water within the borehole that limited visibility and the inability to advance the downhole camera past 286 ft bgs;

After completion of the borehole geophysics, these data obtained were compared to the lithologic logs for each monitoring well. According to the lithologic logs for monitoring well MW-4L, the top of the Prairie du Chien was noted at 110 ft bgs. The lithologic log for monitoring well MW-6L indicated that the top of the Prairie du Chien Group was encountered at approximately 225 ft bgs. The logs indicate that the thickness of the Prairie du Chien Group in monitoring well MW-4L and MW-6L varies from approximately 165 to 205 feet respectively. The Prairie du Chien Group is divided into the upper Shakopee unit and lower Oneota dolomite. Published references indicate that the HTZ is within the middle of the Prairie du Chien Group near the contact between the Shakopee and Oneota dolomite. From this information the HTZ is projected to be at 190 ft bgs in MW-4L and 325 ft bgs in MW-6LR.

Hydraulic communication between the shallow Shakopee and underlying HTZ can occur through vertical fracturing within the upper Prairie du Chien Group (Tipping et al, 2006). This is the likely mechanism for flow observed in the fracture identified at 152 ft bgs in monitoring well MW-4L. While this fracture is above the expected depth of the HTZ, the flow observed in the video inspection log at this depth indicate that the open borehole



section of monitoring well MW-4L is in hydraulic communication with a primary flow zone supplying groundwater to the Barrier Well network. In addition, during the Barrier Well shut down tests performed at the site in May 2007 and May 2008, the groundwater elevation in monitoring well MW-4L is lower compared to adjacent monitoring wells MW-4 and S09JS under pumping conditions. This data, in combination with the data collected during the borehole geophysics program, indicate preferential flow across the zone monitored by the open borehole section of monitoring well MW-4L. Specifically, flow occurs upward from the underlying Jordan Sandstone and downward from the shallow Prairie du Chien unit into a portion of the open borehole section of monitoring well MW-4L.

At monitoring well MW-6LR, the highly fractured zone identified at 280 to 290 ft bgs is approximately 55 feet below the top of the Prairie du Chien Group. This zone is at a depth likely intercepting the upper portion of the HTZ within the Prairie du Chien. However, the depth where different geologic units (e.g. St. Peter Sandstone and Prairie du Chien) are present at monitoring well MW-6LR indicate a vertical offset compared to other areas. A geologic cross-section was constructed to aid in visualizing the subsurface geologic conditions in the vicinity of monitoring wells MW-6LR and MW-4L (see Figure 3-1 for the location of the cross-section). The cross-section was constructed along a north-south transect along the western site property boundary using lithologic information collected during drilling activities. As shown in Figure 3-2, the St. Peter Sandstone and Prairie du Chien Group are interpreted to be vertically displaced downward at monitoring well MW-6LR. Therefore, MW-6LR is not in direct hydraulic communication with other areas of the site due to the vertical displacement of geologic units.

Additional geophysical work is planned in this area to confirm the interpretations presented in the cross-section.

3.3 WATER LEVEL MONITORING

The water level monitoring program for the site consists of monthly manual depth-to-groundwater measurements recorded at all monitoring wells as shown in Table 2-1.



MPCA requested that transducers with the dataloggers be installed in a minimum of four wells completed in the Jordan Sandstone, Prairie du Chien Group, St. Peter Sandstone and glacial drift aquifers. In response to this request, dataloggers were initially installed in January 2011 in the following site monitoring wells:

- Monitor well MW-H – screened within the glacial drift sediments in the buried bedrock valley west of the site;
- Former residential well WR03 – screened within the Jordan Sandstone west of the Barrier Well network;
- Monitor well MW-6 – screened within the St. Peter Sandstone south of Barrier Wells B-1, B-3, and B-4;
- Monitor well MW-4L – screened within the middle of the Prairie du Chien formation near Barrier Well B-1. A transducer was installed in this well prior to monitor well MW-6L being reconstructed. After the re-drilling and reconstruction of monitor well MW-6LR, the transducer in monitor well MW-4L was moved to monitor well MW-6LR.

The four monitoring wells where the dataloggers are installed are the closest monitoring wells that are hydraulically downgradient of the disposal areas. The dataloggers were programmed to collect water level data at 15-minute intervals.